

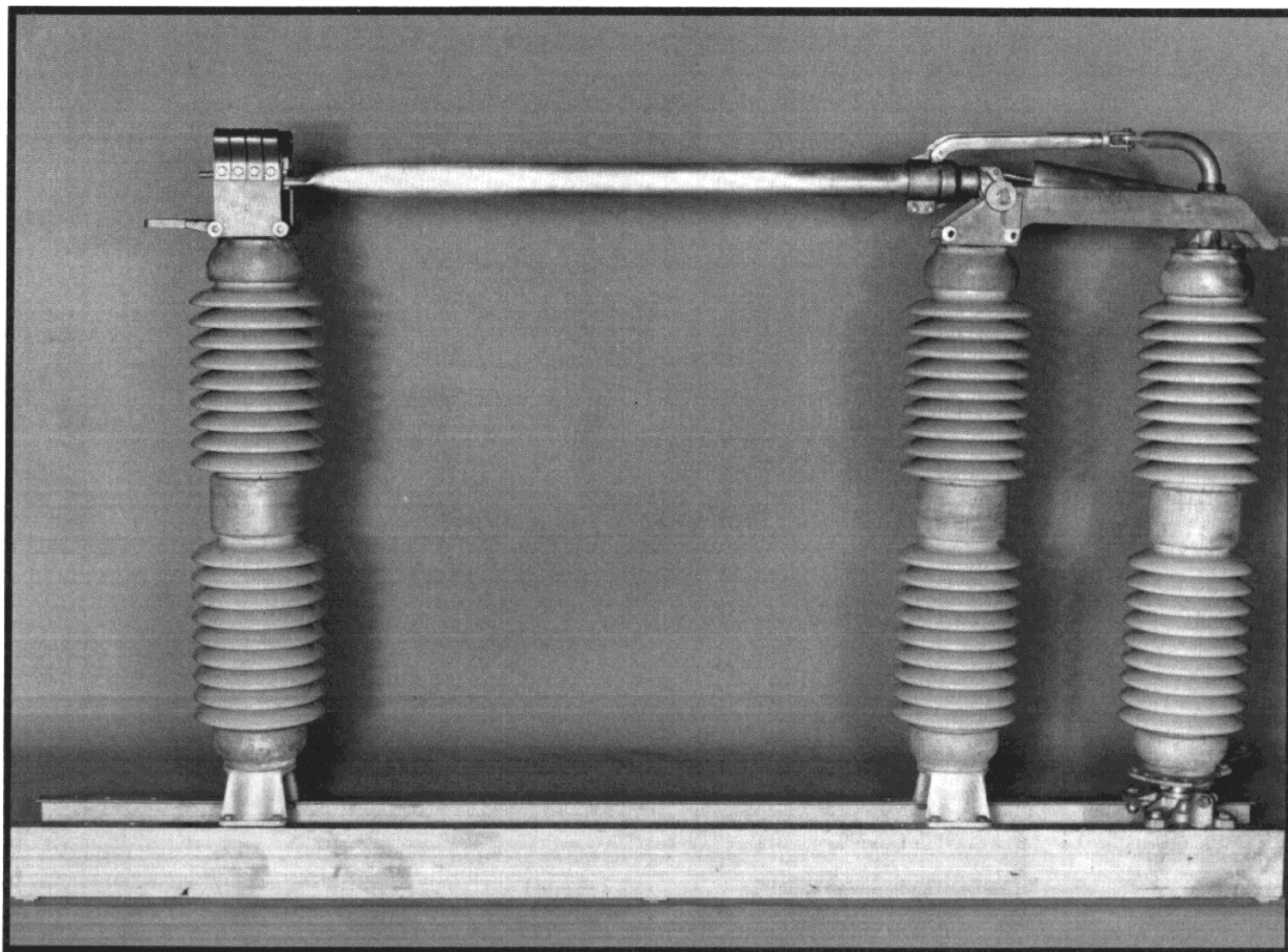
IB-TTR8-A



# Installation & Maintenance Instructions for Type TTR8 Outdoor Air Switch

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Type TTR8  
Group-Operated  
Vertical Break  
8.25 through 230 kV Maximum Design



## IMPORTANT

Read the entire manual before installing and maintaining equipment. Make absolutely sure that applicable equipment is de-energized and properly grounded.

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**Notice 1**

Based on our own experience, you will obtain the best possible operational reliability by following the recommendations given in these instructions. The data contained herein purports solely to describe the product, and it is not a warranty of performance or characteristics. It is with the best interests of our customers in mind that we constantly strive to improve our products and keep them abreast of advances in technology. This may lead to discrepancies between a product and these instructions.

**Notice 2**

Within the scope of these instructions, it is impossible to take into account every eventuality which may arise with technical equipment in service. Please consult our local salesman in the event of any irregularities, especially if not referred to herein.

**Notice 3**

We expressly decline liability for damages resulting from any incorrect operation or wrong handling of our equipment, even if these instructions contain no specific indication in this respect. We stress the fact that only genuine spare parts should be used for replacements.

**Notice 4**

This publication is a copyrighted work. Therefore, it is not permissible to disclose, reprint, copy, or reproduce any part of these instructions without express written permission from ABB.

These instructions do not purport to cover all details or variations in equipment nor to provide for every possible contingency to be met in connection with installation, operation, or maintenance. Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the ABB Power T & D Company Inc. Power Circuit Breaker Division, 125 Theobald Ave., Greensburg, PA 15601, Phone No. (412) 838-5200.

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# TTR8 OUTDOOR AIR SWITCH

## 1. INTRODUCTION

The Type TTR8 Switch (Fig. 1) is a versatile, adaptable outdoor air switch. This three-insulator, vertical-break air disconnect switch exceeds standards set by ANSI C37 and IEC and is designed for many applications:

- Disconnecting the main line
- Sectionalizing a bus
- Isolating a breaker
- Bypassing a breaker
- Disconnecting a transformer
- Interrupting line-charging and transformer magnetizing current (when equipped with interrupter attachments).

The switch contains three moving current transfer contacts with only one contact exposed to the environment. Highly conductive, durable aluminum alloys and silverplated contacts ensure the integrity of the current-carrying components. All hardware is made of corrosion-resistant materials. A galvanized struc-

tural steel base supports the insulators and live parts for stability and durability. The switches can be mounted upright, inverted, or vertically.

Other features of the TTR8 Switch include:

- Standard bases to fit most structures
- Switch can be operated manually or by a motor
- Open-close stops on each switch pole
- Package controls available for quick delivery.

The following operators can be supplied for the TTR8 Switch:

- Manual reciprocating operator
- Manual swing handle operator
- Manual worm gear mechanism
- MO-10 motor operator.

The blade (Fig. 2) of the switch raises and lowers both vertically and radially. The contact at the end of the blade enters the jaw at a slight angle and then rotates horizontally to firmly press against the jaw contact fingers. In addition to ensuring definite contact pressure, this dual motion also facilitates ice-breaking on opening.

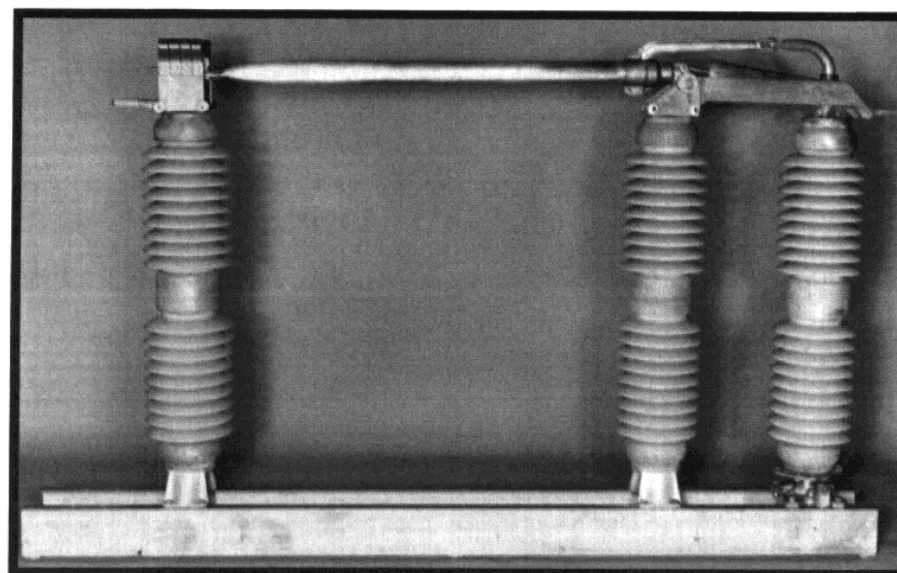


Figure 1  
TTR8 Switch Assembly

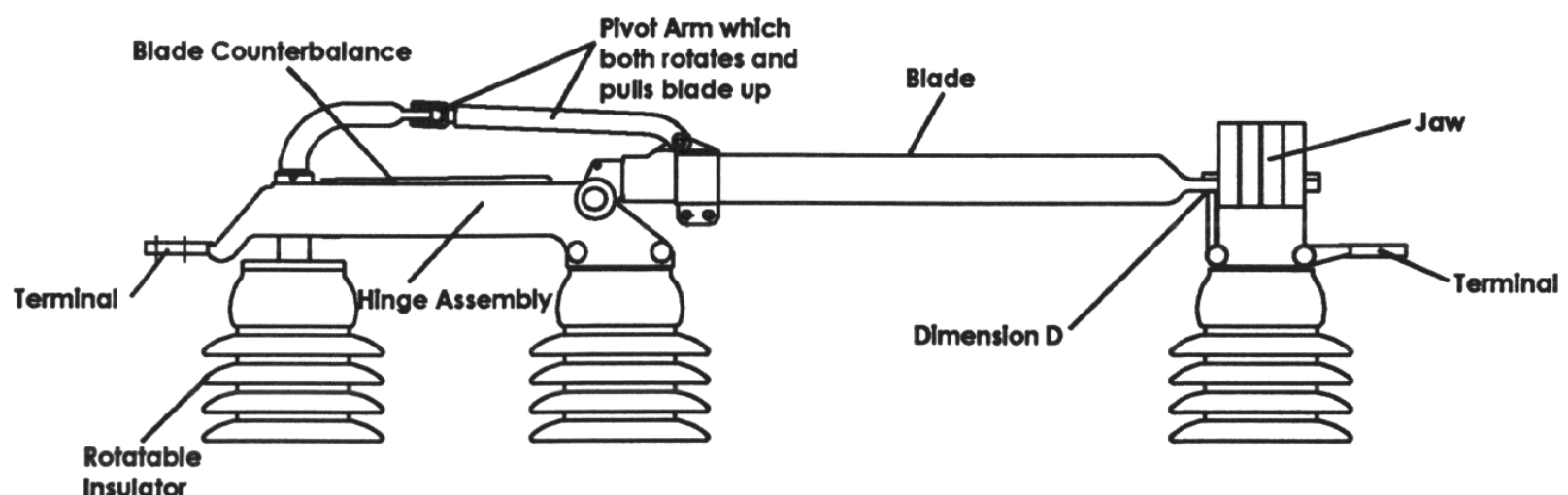


Figure 2  
Top Portion of the TTR8 Switch Assembly

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## 2. SAFETY

### DANGER

**BEFORE ANY INSTALLATION IS STARTED, MAKE ABSOLUTELY SURE THAT APPLICABLE EQUIPMENT IS DE-ENERGIZED AND PROPERLY GROUNDED. PROTECT THE INSTALLERS ADEQUATELY FROM ADJACENT ELECTRICALLY ENERGIZED PARTS BY USING BARRIERS, SCREENS, ETC.**

Follow the instructions in this manual to prevent accidents and failures. The instructions are written in terms that should be readily understood by well-trained, competent operators. Personnel should thoroughly understand the instructions in this manual before operating this equipment.

Operating switches and related electrical and mechanical components present inherent dangers. Therefore, adhere to the procedures presented herein in the step-by-step sequence for the safety of personnel and equipment.

Hazard alert nomenclature (safety precautions and tips) used in this manual are: danger, warning, caution, notice, and important. These terms comply with standards set forth in ANSI Z535. These hazards are defined and appear in this manual as follows, starting with the most serious hazard alert term and descending to the least serious:

### DANGER

**DANGER INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.**

### WARNING

**WARNING indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

### Caution

**CAUTION indicates a hazardous situation which, if not avoided, may result in minor or moderate injury.**

**Notice:** *NOTICE is used for hazards that may result in property damage only.*

**Important:** *IMPORTANT designates an operating tip or maintenance suggestion.*

## 3. RECEIVING, HANDLING, & STORAGE

When receiving the TTR8 Switch:

1. Check that the total shipment is complete as per the bill of materials and installation drawings.
2. If the shipping crate and/or switch show signs of damage note the damage on the bill of lading.
3. Carefully lift the disconnect switch at the switch base unless specified otherwise. Do not lift the switch by insulator units, contacts, or live parts.

### Caution

**The TTR8 Switch contains porcelain components; porcelain is extremely brittle and can be easily cracked or broken by impact jarring or careless handling. When lifting or transporting the switch, take precautions to prevent bumping the switch components – especially porcelain.**

**Exercise care when handling the blade, hinge, and jaw assemblies to avoid scratching or damaging these current-carrying parts.**

4. Store the switch in a safe area, protected from damage.
5. Refer to section 4 for assembly and installation instructions.

## 4. ASSEMBLING AND INSTALLING THE TTR8 SWITCH

Refer to the installation flow chart at the end of this publication.

### DANGER

**BEFORE ANY INSTALLATION IS STARTED, MAKE ABSOLUTELY SURE THAT APPLICABLE EQUIPMENT IS DE-ENERGIZED AND PROPERLY GROUNDED. PROTECT THE INSTALLERS ADEQUATELY FROM ADJACENT ELECTRICALLY ENERGIZED PARTS BY USING BARRIERS, SCREENS, ETC.**

**Important:** *Refer to the installation drawings provided with the switch for specific assembly and installation instructions.*

If the switch has not already been assembled at the factory, installing the TTR8 Switch begins with assembling the insulators and live components on the ground.

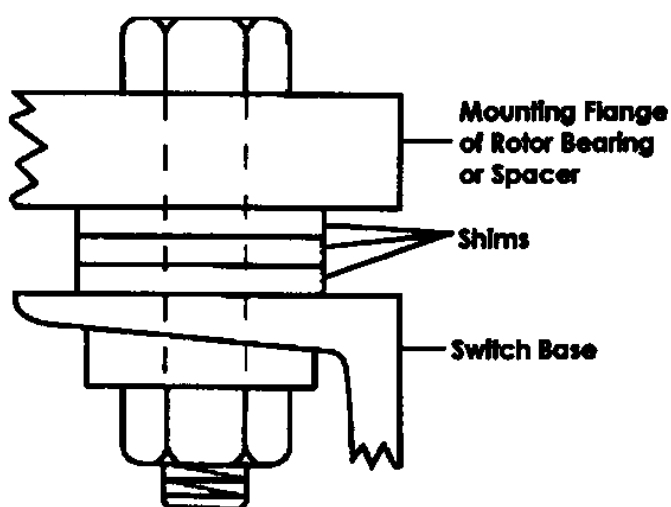
**Important:** For higher voltage switches, it may be easier to mount the switch base on the support structure and then assemble the insulators and live components.

To assemble the switch pole units, refer to section 4.1, then proceed to section 4.2 for final installation and adjustments. If the switch pole units were pre-assembled at the factory, proceed to section 4.2 for final installation and adjustment.

#### 4.1 Assembling the Switch Pole Units

To assemble the TTR8 switch pole units:

1. Check the bases to make sure that the insulator supports, spacers, and rotor bearing tops are square and level.
2. The tops on the two supports on the hinge end must be level and exactly the same height. If necessary make adjustments or add shims.
3. Assemble the insulators to the switch base and rotor bearing without disturbing the position of the switch crank stops. The switch crank stops have been set at the factory. In some cases, involving higher voltage switches, the installer may choose to mount the switch bases on the structure before assembling the insulators. In such cases, the switch bases should be mounted on the supporting structure in the positions shown on the installation drawing. The bases should be level and parallel to each other. Make sure that the base for the drive phase is in the correct location and operating cranks at their proper angle.
4. Lower voltage switches 8.25 thru 72.5 kV generally do not require insulator stack alignment. Where required, the insulator stacks of switches thru 242 kV can be aligned using open-end shims (Fig. 3) or leveling screws and/or adjusting nuts (Fig. 4) if supplied (optional).

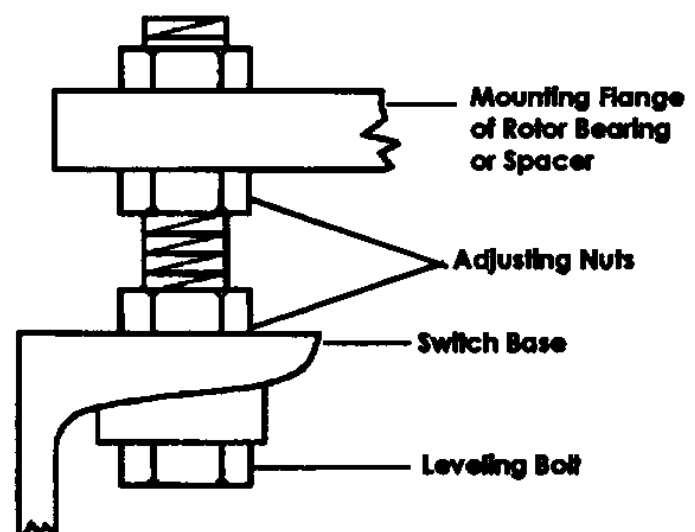
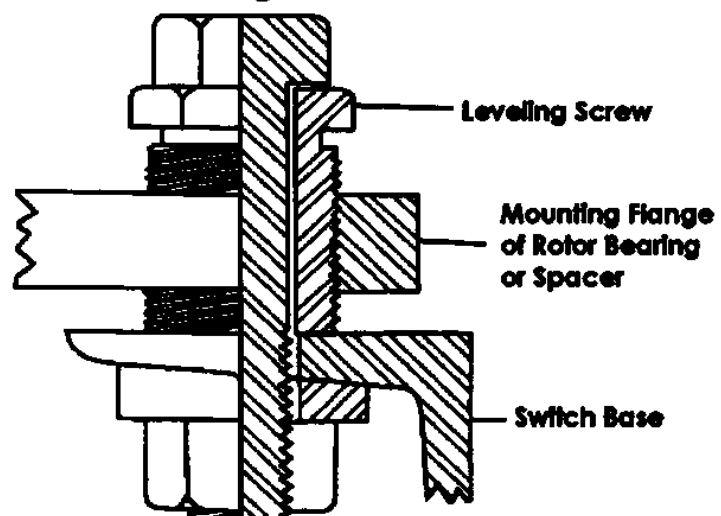


**Figure 3**  
Shims Used for Leveling Switches  
from 72.5 kV to 242 kV

- If using shims, place the shims under the insulator supports (rotor bearing or spacer mounting flange) where the bolts secure the rotor bearing or spacer mounting flange to the switch bases.
  - If optional leveling screws and/or adjusting nuts have been supplied, as shown in Fig. 4, adjust the leveling screw and/or adjusting nut to align the insulator stacks.
5. Assemble the live parts (blade, hinge, and jaw assemblies, etc.) (Fig. 2) to the switch as follows:
    - Exercise care when handling the blade, hinge, and jaw assemblies to avoid scratching or damaging these current-carrying parts.
    - When uncrating switches having blade counterbalances (Fig. 2), be careful to keep the linkage on dead center until the blade and hinge assembly have been bolted in place on the insulator columns.

#### Caution

When uncrating switches which have blade coun-



**Figure 4**  
Leveling Screws and Adjusting Nuts

terbalances (Fig. 2), be careful to keep the linkage dead center until the blade and hinge assembly have been bolted in place on the insulator columns (when assembling the switch). Otherwise, the counterbalance springs may collapse the hinge end toggle which could injure personnel.

- Check that the base crank is rotated to the maximum counter-clockwise position with the blade closed.
  - Fasten the blade and hinge assembly to the support insulators as shown in Fig. 2.
  - When assembling the jaws on the insulator columns, keep the jaw base hold-down bolts finger-tight to allow the jaw base to be rotated and shifted slightly as needed to align the contacts during final installation as per section 4.2.
6. Proceed to section 4.2 for final installation and adjustment procedures.

## 4.2 Installation and Final Adjustment

### DANGER

**MAKE ABSOLUTELY SURE THAT THE SUPPORT STRUCTURE FOR THE SWITCH IS PROPERLY GROUNDED.**

Follow the factory installation drawings enclosed with the TTR8 Switch.

If the switch pole units were not pre-assembled at the factory, refer to section 4.1. To install the switch pole unit, proceed as follows:

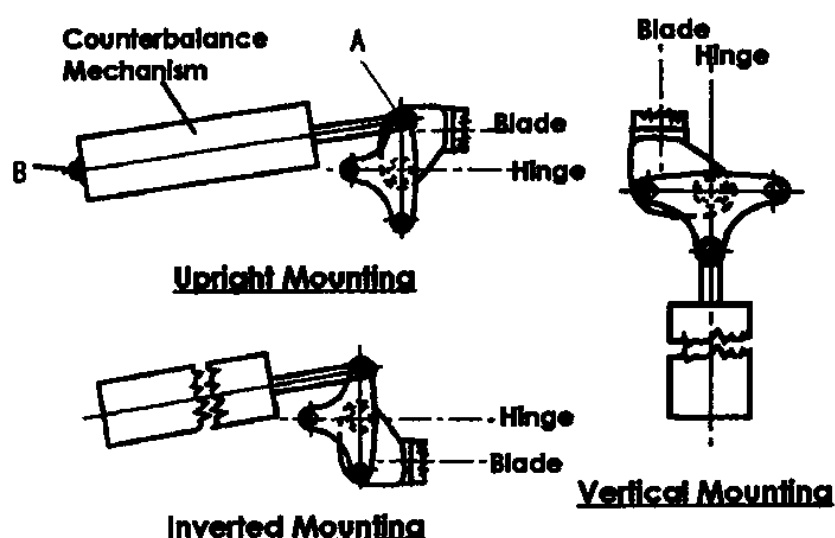
- Mount and position the switch pole units (section 4.2.1)
- Adjust the blades (section 4.2.2)
- Mount the offset bearing (section 4.2.3)
- Adjust the multi-angle crank (section 4.2.4)
- Install the interphase rods and offset crank rod (section 4.2.5)
- Install the vertical operating pipe (section 4.2.6)
- Install the pipe splice and guide plate (section 4.2.7).

### 4.2.1 Mounting and Positioning the Switch Pole Units

Mount the switch pole units level and parallel with each other as per the installation drawings and Fig. 6 (on the next page). Insert shims between the support structure and switch base as needed to ensure that the switches are level.

Mounting precautions include:

- Be certain that the rigging gear is appropriate and suited for hoisting the equipment.



**Figure 5**  
**Mounting Positions of the Blade Counterbalance Mechanism**

- Unless otherwise directed in these instructions, attach the hoisting equipment to switch bases.
- Do not lift switches by the insulators, contacts or live parts (to avoid damaging the parts).

Figure 5 shows connections for various switch mountings for voltage or current rating applications in which blades are counterbalanced. The counterbalances are assembled at the factory for the mounting positions as required for each installation. The counterbalances must be changed as described in the proceeding sub-sections if the mounting position of the switch in the field is to be changed.

- Upright to vertical position (section 4.2.1.1)
- Change to inverted position (section 4.2.1.2)

#### Caution

**Exercise care when hoisting the blade hinge and jaw assemblies into position to avoid scratching or damaging these current-carrying parts.**

#### 4.2.1.1 Changing from the Upright to the Vertical Position

#### Caution

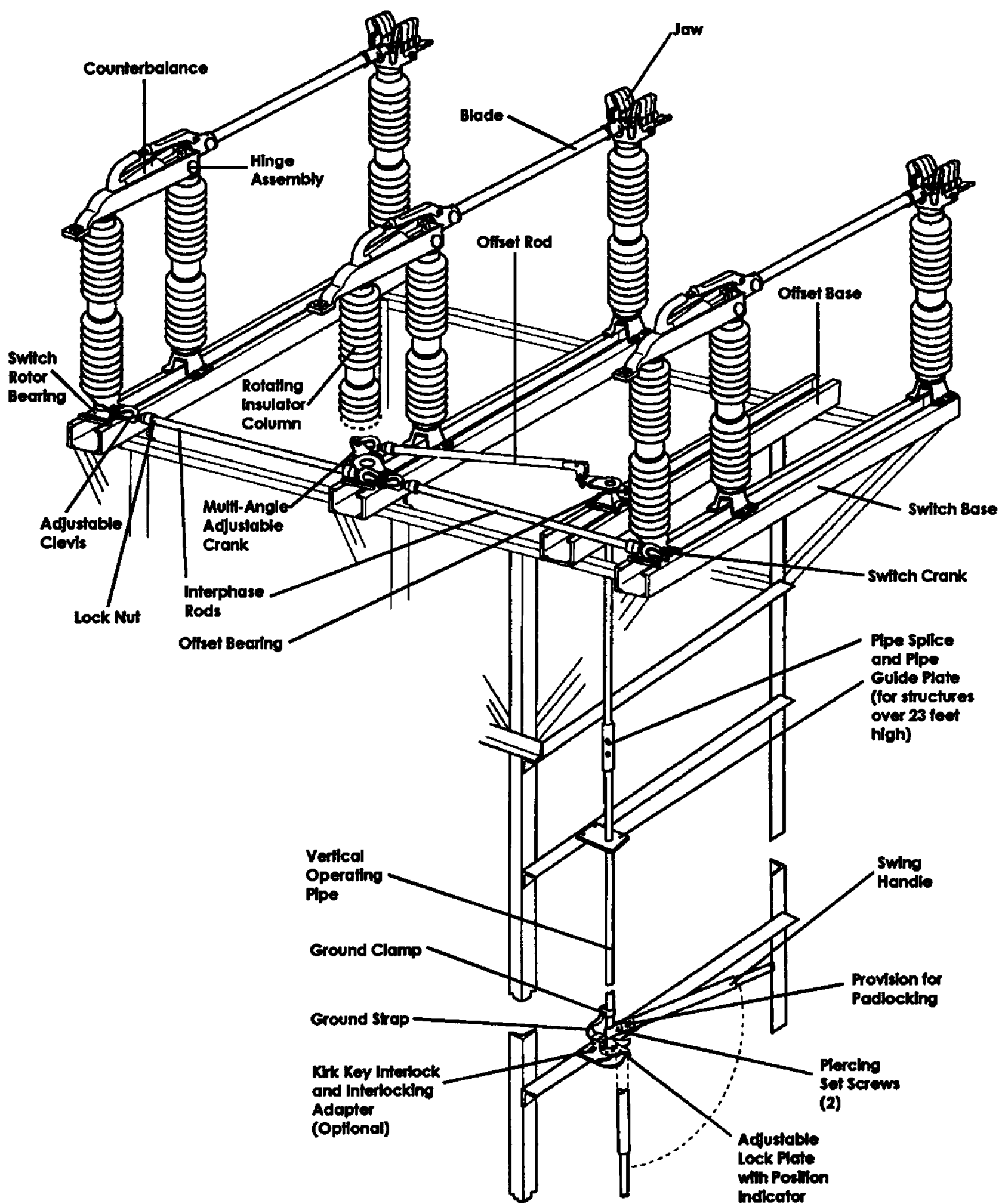
**When performing this procedure, use care because parts are in tension.**

To change the switch position from upright to vertical:

1. Open the switch blade to approximately the 75° position.
2. Clamp the plunger of the counterbalance with vise grip pliers against the face of the housing.
3. While maintaining a good hold on the blade with your hand, carefully open the blade a few more degrees or enough to relieve pressure.

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**Figure 6**  
**Typical Three-Pole TTR8 Switch Installation (Including Typical Offset Bearing)**

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4. Remove pin A (Fig. 5) which attaches the plunger to the blade hinge casting. Since this pin is larger in diameter at the center and two shoulders hold it in place, the pin may be a bit difficult to remove.
5. Lower the blade to approximately a 15° angle.
6. At or near this point, connect the counterbalance plunger to the proper point for vertical mounting by re-installing pin A.
7. Raise the blade to relieve pressure.
8. Remove the vise grip pliers.
9. File off any burrs on the counterbalance shaft.
10. Proceed to section 4.2.2.

#### 4.2.1.2 Changing to the Inverted Position

**Notice:** Before performing this procedure, contact the factory.

To change the switch to the inverted position:

1. Start with the switch blade in the CLOSED position.
2. Clamp the counterbalance plunger with the vise grip pliers against the face of the housing.
3. Raise the blade slightly to relieve pressure.
4. Remove pin A (Fig. 5) which attaches the plunger to the blade hinge casting. Since this pin is larger in diameter at the center and two shoulders hold it in place, the pin may be a bit difficult to remove.
5. Remove pin B (Fig. 5) at the rear of the counterbalance. The unit is now freed to be inverted.
6. Re-connect the rear of the counterbalance with Pin B.
7. Remove the jaw assembly from its support insulator.
8. Lower the blade below the CLOSED position and connect the counterbalance plunger to the proper point for inverted mounting.
9. Raise the blade to relieve pressure.
10. Remove the vise grip pliers.
11. File off any burrs on the counterbalance shaft created from the vise grip pliers.
12. Re-install the jaw assembly; hand tighten the bolts.
13. Proceed to section 4.2.2.

#### 4.2.2 Adjusting the Blade

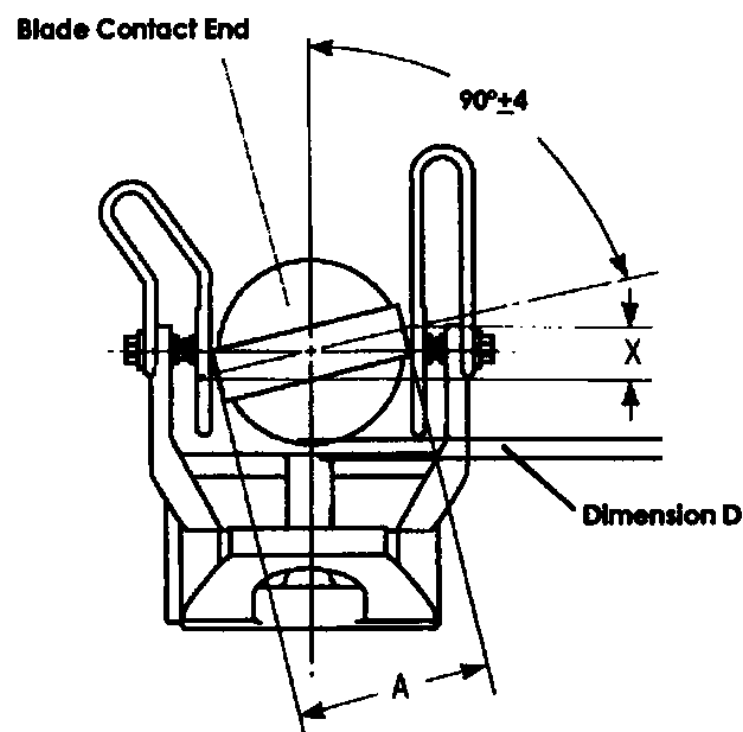
To adjust the blade:

1. Make sure that the stop bolts at the base of the rotating insulators do not prevent the switch from traveling to the complete OPEN and CLOSE positions.

**Important:** When looking down on the rotating insulator column, rotating the insulator column clockwise opens

the switch; rotating the insulator counter-clockwise closes the switch.

2. On each pole unit, lower the blades slowly to the CLOSED position to determine if the blade contact enters the jaw in the central position. If it does not, loosen the hinge assembly mounting bolts on the stationary insulator stack and with the blade just out of the jaw, shift the blade into alignment and tighten the hinge assembly mounting bolts. If the blade still does not enter the center of the jaw, shim the jaw insulator stack to attain the central entry orientation. Once the central entry is attained, rotate the blade into the jaw contact and tighten the jaw base mounting bolts.
3. Check that the jaw fingers are nearly centered on the blade end contact. If the conductors or bus to be connected to the terminal (Fig. 2) of the switch jaw assembly will exert a strong horizontal pull on the jaw assembly and insulator column, adjust the jaw insulator column so that it tilts slightly toward the hinge end of the switch to correct for line pull. The blade must rotate radially on opening and closing to relieve jaw contact pressure. The allowable difference in elevation from one side of the blade contact to the other (Dimension X (Fig. 7)) is 1/16-inch for each 1-inch of contact width. For example: if contact width (A) is 4-1/2 inches, then Dimension X can be as much as 9/32-inch and still be within the  $\pm 4^\circ$  tolerance. Figure 7 also shows the blade contact angle high (right in Fig. 7) and low (left in Fig. 7). The converse is true, low on the right and high on the left. It is common to



**Figure 7**  
**Blade Contact Angle (End View)**

have both blade angle schemes on one three-pole switch due to variables and tolerances plus the free play or clearance in pin connections of all of the switches and control parts, e.g. after all three poles have been adjusted in the OPEN position, one pole may be high on the right, one fairly level, and one high on the left. Variations in blade contact angle are not significant because contact pressure is not reduced until the blade angle exceeds  $\pm 8^\circ$  from the horizontal.

4. In Fig. 7, Dimension D can vary from zero to 5/8-inch with the switch in the CLOSED position. This dimension usually cannot be equal on all three poles of a three-pole switch. To adjust dimension D (Fig. 7):

Remove connecting pin A (Fig. 5) and turn the clevis in or out a half turn. Turning the clevis in will move the blade away from the pry-out fulcrum; turning the clevis out will move the blade closer to the fulcrum in the switch in the CLOSED position.

5. Re-install connecting pin A and try the switch. If the switch does not operate properly, repeat this procedure.
6. Proceed to section 4.2.3.

#### 4.2.3 Mounting the Offset Bearing

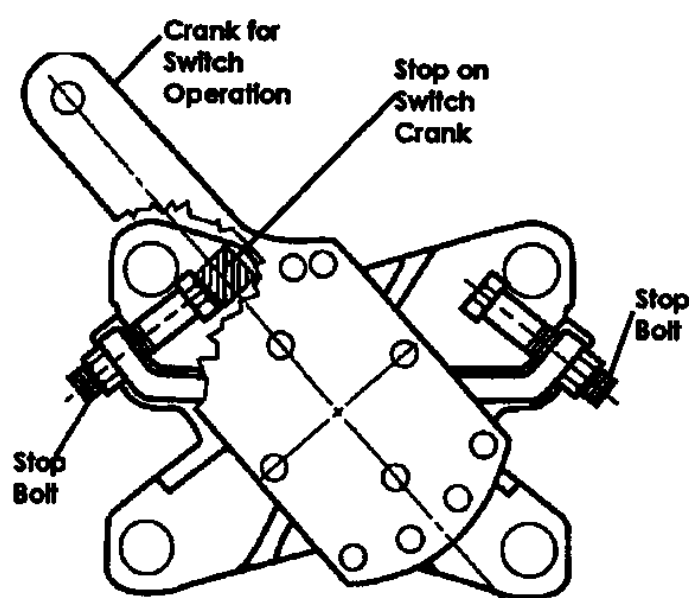
Bearings in the switch and offset bearing are greaseless. Figure 8 shows the location of stop bolts and switch cranks on all switch bearings. Figure 9 shows an elevated view of the switch bearing. Figure 10 shows the required location of stop bolts and the stop crank as well as the typical location for the adjustable radius crank on the offset bearing.

The offset bearing may use a two-piece adjustable radius crank plus a separate stop crank with multiple mounting holes for angular adjustment. Refer to Figs. 11 and 12.

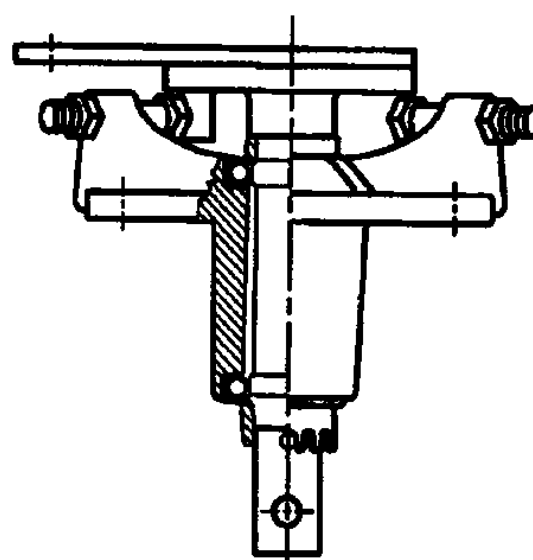
To mount the offset bearing and its supporting base on the structure, refer to your installation drawings. Figure 6 illustrates a typical TTR8 Switch arrangement using the offset bearing.

Check the installation drawings to ensure that the operating crank is set at the proper radius and angle. Also check that the stop crank is at the proper position.

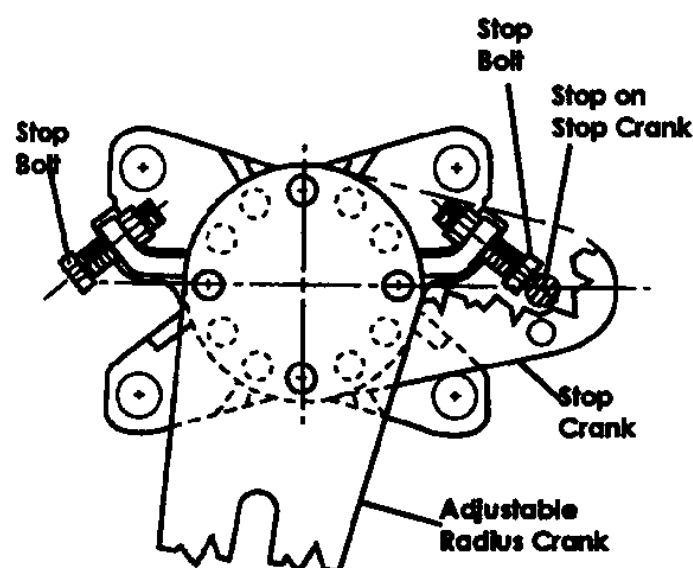
If the offset bearing has an adjustable crank, 1/4 to 1/2-inch may need to be added to the trial radius on the drawing to attain the required travel of the switch blades. This extended radius allows for lost motion and clearances in pin holes and provides an audible sound and deflection as the crank crosses the dead center position indicating that the switch is either fully OPEN or CLOSED.



**Figure 8**  
Typical Bearing Used on Switch Poles  
(Plan View)



**Figure 9**  
Typical Bearing Used on Switch Poles  
(Elevated View)



**Figure 10**  
Typical Offset Bearing

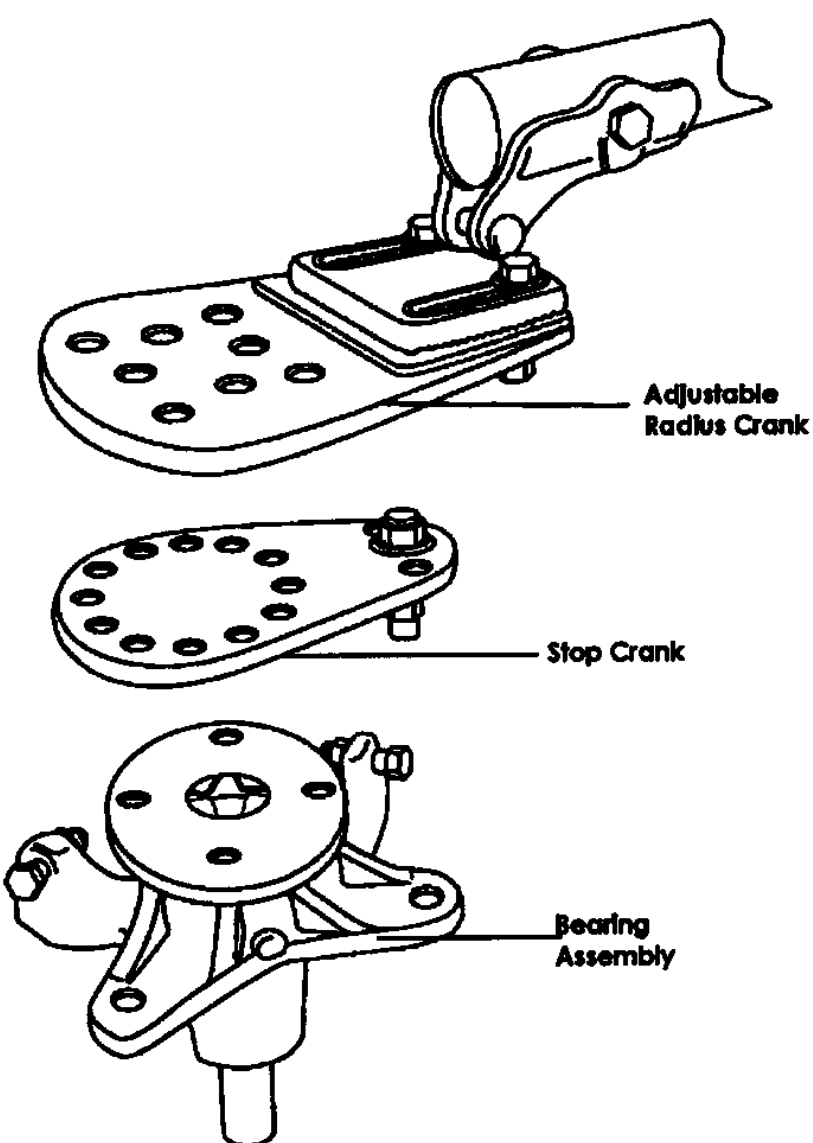


Figure 11  
Exploded View of Offset Bearing and Cranks

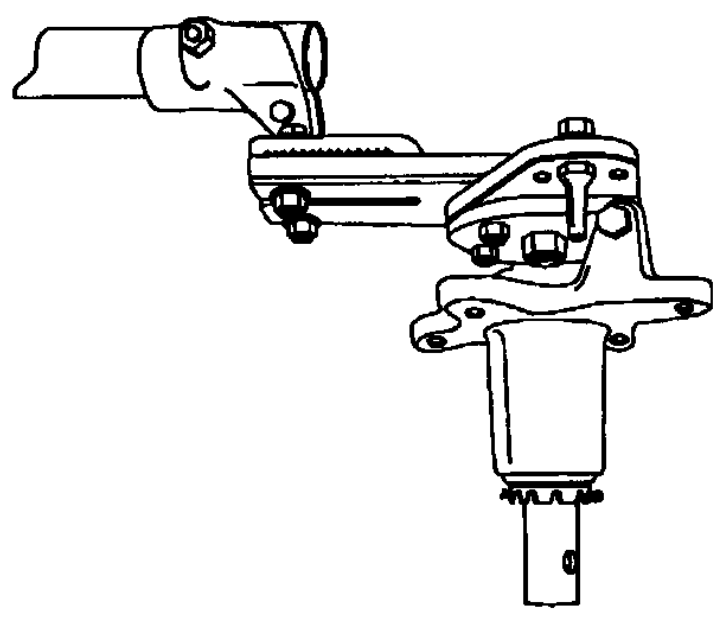


Figure 12  
Typical Offset Bearing and Cranks

4.2.4 Adjusting the Multi-Angle Crank

The two switch poles that are not connected to the offset bearing normally use a single crank, similar to the one shown in Fig. 13. The switch pole that is connected to the offset bearing (drive phase) uses either a solid double crank or a two-piece adjustable, multi-angle crank as shown in Fig. 14.

The multi-angle cranks (Figs. 6 and 14) are located on the operating pole unit that is connected to the offset bearing.

The bolt circle radius for the insulator determines the type of multi-angle crank that is installed on the unit. Refer to Table 1 on the next page.

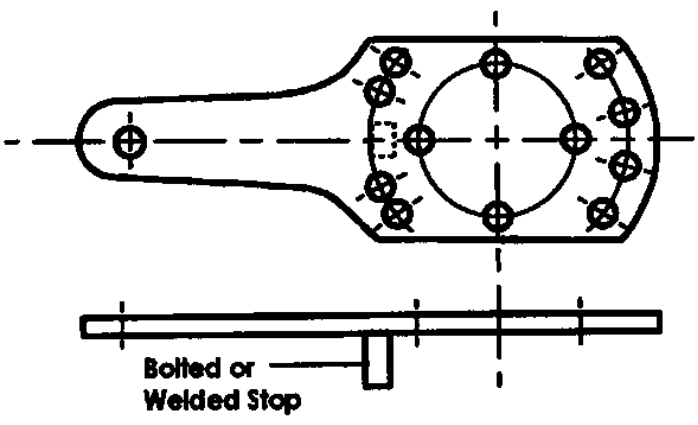


Figure 13  
Single Crank Used on Medium Voltage Switches, Non-Drive Phases

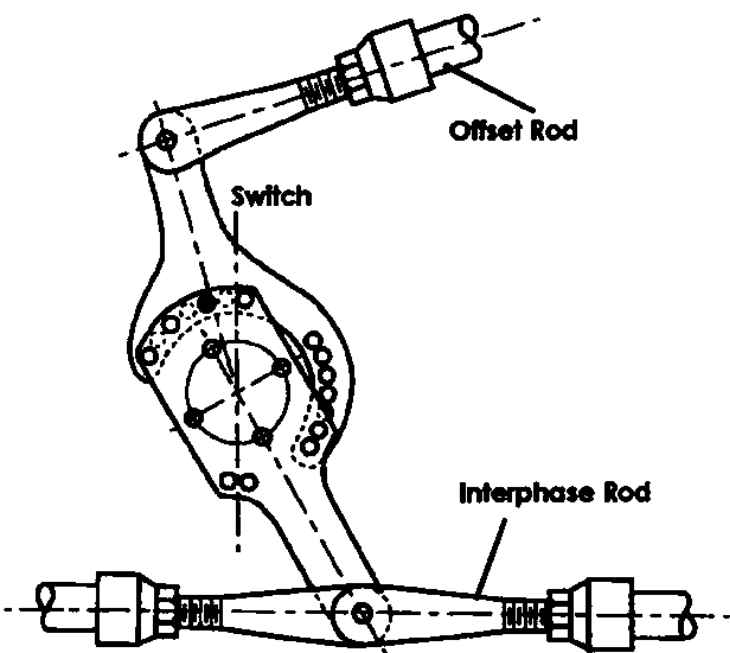


Figure 14  
Operating Pole Adjustable, Multi-Angle Crank

Table 1 Multi-Angle Cranks	
Insulator Bolt Circle Radius	Type of Multi-Angle Crank
3-Inch Bolt Circle Insulator Radius	333° of angular adjustment Crank location of every 9° Allows adjustments to within 4-1/2° of desired position
5-Inch Bolt Circle Insulator Radius	336° of angular adjustment Crank location of every 12° Allows adjustments to within 6° of desired position

The multi-angle crank should be set so that it forms a 45° angle with the offset link in either the OPEN or CLOSE switch position.

In some adjustments, the position of the adjustable multi-angle crank may interfere with the stop projection

on the switch crank. To correct this problem, remove the stop projection. The other two poles will regulate blade travel.

4.2.5 Installing the Interphase Rods and Offset Crank Rod (Fig. 6)

*Important:* For the following applications, refer to the drawings that are supplied with the switch to install the interphase rod and offset crank rod:

- Torsional interphase shaft system is used
- Each pole is operated with its own operator.

In all other applications, with all blades in the fully OPEN position, install the interphase rods and offset crank rod as follows:

1. Turn the adjustable clevises to extend the interphase rod that is in *compression* (during the opening stroke of the switch) as much as possible allowing enough room for pins to be inserted.
2. Turn the adjustable clevises to shorten the interphase rod in *tension* (during the opening stroke of the switch) as much as possible allowing enough room for pins to be inserted.
3. If the offset crank rod is in *compression* during the opening stroke, repeat step 1 for this rod. If the offset crank rod is in *tension* on the opening stroke, repeat step 2 for this rod.
4. Lubricate all pins and bearings based on the guidelines in Tables 2a and b.

Table 2a Lubrication Guide for Outdoor Switch Components			
Component	Recommended Lubricant	Amount to Apply	Quantity Required for (6) Three-Pole Switches
Jaw Fingers	NO-OX-ID Grade "A" Special or Darina #2 Grease	Medium Coat	---
Blade Ends	NO-OX-ID Grade "A" Special or Darina #2 Grease	Medium Coat	1 Quart
Pins on Current-Carrying Parts	Darina #2 Grease or DC-4	*	---
Pins on Control Parts	Darina #2 Grease or DC-4	Light Coat	1 Quart
Bearing Areas on Control Parts	Darina #2 Grease or DC-4	Medium Coat	---
Terminal Connections	NO-OX-ID Grade "A" Special or NO 2 EJC	Heavy Coat	1 Quart
*None required on installation unless switches were exposed to abnormal conditions for a considerable length of time. During regular cleaning, apply a light coat.			
All surfaces require preparation as described in sections 9.1 and 9.2			

Table 2b Vendor Guide for Lubricants	
Lubricant	Vendor Address
NO-OX-ID Grease	SANDCHEM INC. Chicago, IL 60616
Darina #2 Grease	Shell Oil Company New York, NY
DC-4 Grease	Dow Corning Corporation Midland, Michigan
NO 2 EJC - Electrical Joint Compound	ALCOA Conductor Products Company Pittsburgh, PA 15212

#### 4.2.6 Installing the Vertical Operating Pipe

The vertical operating pipe (Fig. 15) is pre-drilled at one end for a 5/8-inch diameter pin.

To install the vertical operating pipe:

1. Fasten the vertical operating pipe to the offset rotor bearing shaft (or on the pole unit rotor bearing shaft for direct-connected switches) using the 5/8-inch coupling pins supplied with the unit. Refer to Fig. 15.
2. Install accessory items. Refer to the drawings shipped with the unit for instructions on installing accessory items (auxiliary switches, mechanical interlocks, position indicators, ground straps, etc.) which mount on the vertical operating pipe.

#### 4.2.7 Installing the Pipe Splice and Guide Plate (Only installed for units taller than 23 feet)

A pipe splice and guide plate (Fig. 6) are furnished for structures taller than 23 feet. The pipe splice and both pieces of pipe are drilled to receive the 5/8-inch diameter pins.

1. Install the pipe splice (Fig. 6).
2. Mount the guide plate shown in Fig. 6 (after installing the vertical pipe as per section 4.2.6).
3. Align the hole in the guide plate with the normal position of the vertical pipe without any binding and tighten the bolts on the guide plate.

### 5. INSTALLING THE OPERATING MECHANISM

Two types of manual operating mechanisms are available for the TTR8 Switch:

- Swing-handle operator (section 5.1)
- Worm gear mechanism (section 5.2).

A motor operator also can be supplied for remote operation. Refer to section 5.3.

#### 5.1 Installing the Swing Handle Operator

The operating handle lock plate (Fig. 16) on the swing handle operator is made of two castings mounted on the pipe guide plate. The castings can be easily adjusted in an arc to attain the required rotation. The castings act as locks for the manual operating handle when it is dropped vertically from the operating position. The handle must be raised to a horizontal position for operation.

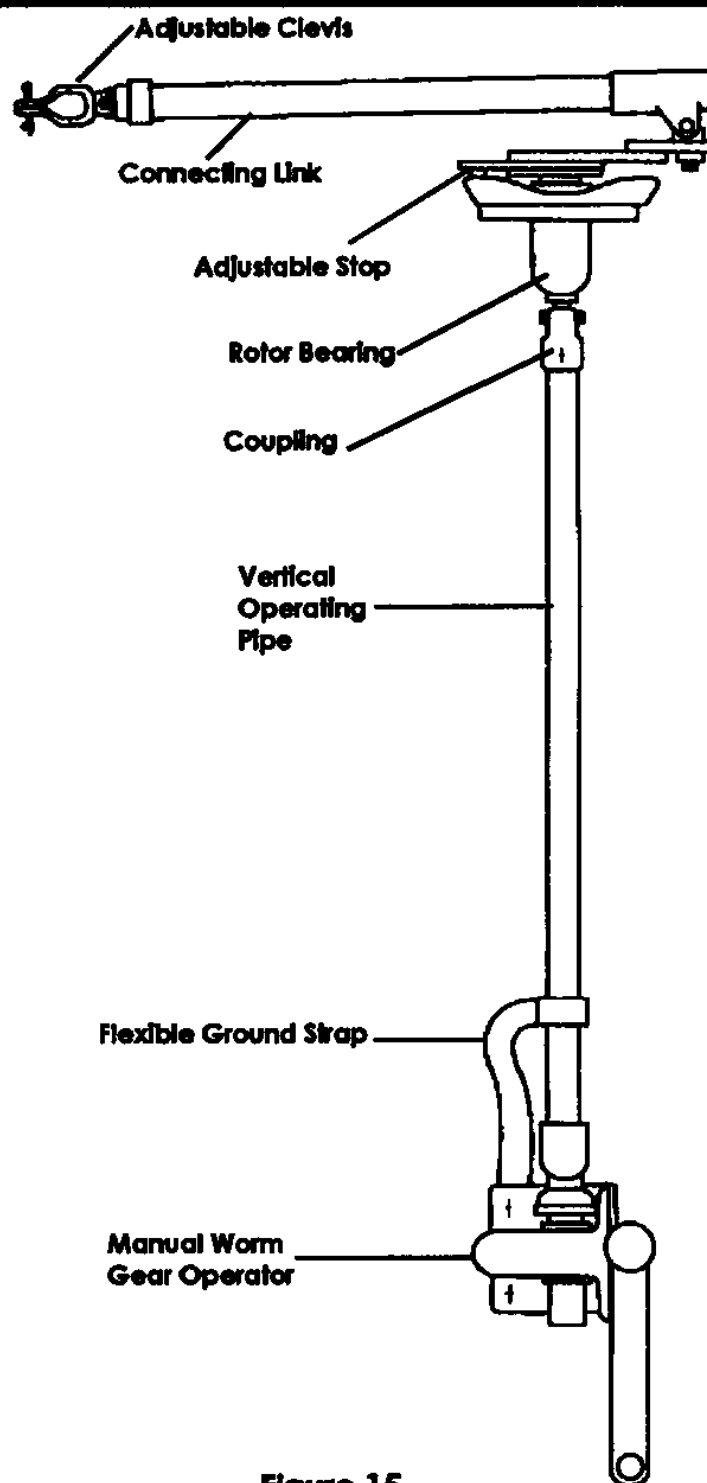


Figure 15  
Manual Worm Gear Operating Mechanism

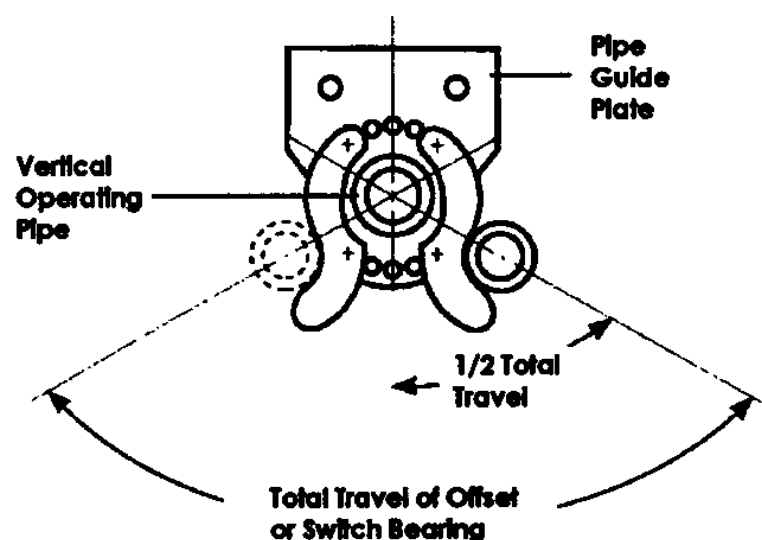


Figure 16  
Operating Handle Lock Plate

To install the swing handle operator:

1. Slide a flexible ground strap on the vertical operating pipe and connect the opposite end to the structure. Ensure that the strap is solidly in place on both the vertical pipe and structure.

### **DANGER**

**SOLIDLY CONNECT THE FLEXIBLE GROUND STRAP TO THE VERTICAL OPERATING PIPE AND TO THE STRUCTURE TO ENSURE POSITIVE GROUNDING OF THE VERTICAL OPERATING PIPE. FOR SAFETY, ENSURE THAT THE STRAP IS SOLIDLY IN PLACE ON BOTH THE VERTICAL PIPE AND STRUCTURE.**

2. Slide the handle and the handle lock plate over the end of the vertical operating pipe.
3. Fasten the lock plate at the proper location. The recommended height for the lock plate is 3 feet, 6-inches above ground.

*Important:* The lower end of the vertical operating pipe should extend through the handle lock plate at least 3 inches or more. The pipe is not to touch the ground or column footing.

4. With the switch in the fully CLOSED position, set the handle clamp so that its set screws are 4 inches above the lock plate and its vertical center line is at or near as possible to the CLOSED position.
5. Temporarily fasten the handle to the pipe with the set screws.
6. Position the adjustable castings so that they exert pressure against the swing handle when it is turned vertically in both the OPEN and CLOSED positions of the switch. (This will create a slight torsional wind up force in the operating pipe.)
7. Tighten the two set screws on the handle clamp. Turn the screws until they pierce the pipe and become firmly seated.

### **5.2 Installing the Worm Gear Mechanism**

To install the worm gear mechanism:

1. Slide a flexible ground strap on the vertical operating pipe and connect the opposite end to the structure. Ensure that the strap is solidly in place on both the vertical pipe and structure.

### **DANGER**

**SOLIDLY CONNECT THE FLEXIBLE GROUND STRAP TO THE VERTICAL OPERATING PIPE AND TO THE STRUCTURE TO ENSURE POSITIVE GROUNDING OF THE VERTICAL OPERATING PIPE. FOR SAFETY, ENSURE THAT**

**THE STRAP IS SOLIDLY IN PLACE ON BOTH THE VERTICAL PIPE AND STRUCTURE.**

2. Slide the worm gear mechanism over the vertical operating pipe and attach the worm gear mechanism to the structure.
3. Remove the small position indicators on the worm gear coupling by removing the Allen set screws.
4. Tighten the square head set screws in the worm gear coupling until they pierce the vertical operating pipe.
5. Operate the three-pole switch manually.
6. Check the switch for proper adjustment.
7. If all stops at the switch elevation have been set, including the offset bearing, it is safe to re-install the position indicators. Install the position indicators so that they do not quite touch the raised boss on the worm gear housing in either the OPEN or CLOSED position.

*Notice:* Do not use the OPEN-CLOSE position indicators as stops.

### **5.3 Installing the Motor Operator**

A motor operator is used for remote operation. To install the motor operator:

1. Slide a flexible ground strap on the vertical operating pipe and connect the opposite end to the structure. Ensure that the strap is solidly in place on both the vertical pipe and structure.

### **DANGER**

**SOLIDLY CONNECT THE FLEXIBLE GROUND STRAP TO THE VERTICAL OPERATING PIPE AND TO THE STRUCTURE TO ENSURE POSITIVE GROUNDING OF THE VERTICAL OPERATING PIPE. FOR SAFETY, ENSURE THAT THE STRAP IS SOLIDLY IN PLACE ON BOTH THE VERTICAL PIPE AND STRUCTURE.**

2. Follow the installation instructions shipped with the motor operator.

#### **Caution**

When installing the motor operators, de-energize the drive motor circuit using the motor limit switches just before the switch pole unit stops and the offset bearing stop reach their limits.

### **5.4 Lubrication**

For lubrication guidelines, refer to Tables 2a and b.

6. INSTALLING THE ARCING HORN

Arcing horns are supplied only when horn gap switches are ordered. Arcing horns consist of a movable straight horn and a stationary horn. Arcing horns for 242 kV switches are essentially the same except that the stationary horn contacts the movable horn at the surface between the end of the blade and the small corona ball affixed at the end of the movable horn. If arcing horns have been supplied, install and adjust them after mounting the switches on the structure.

To install the movable straight horn:

- 1. Screw the straight horn into the blade end.
- 2. Tighten the locking nut seat securely against the end of the blade.

To install the stationary horn:

- 1. Bolt the stationary horn on the jaw with the saddle clamp.
- 2. Adjust or slightly bend the stationary horn to apply light contact pressure between the two horns over the entire length of the stationary horn.

7. INSTALLING THE CORONA RINGS AND BALLS

The 242 kV switches use corona rings at the jaw end and a small ball on each end of the blade. (Switches rated at 169 kV and below do not require corona rings and balls.)

If corona rings and balls have been supplied, install these components as shown on the single pole drawings.

*Important: Prepare areas where ring supports contact switch parts as per instructions for aluminum connections in section 9.1.*

8. FINAL INSTALLATION CHECKS

Check all three poles for the following:

- Blades stand vertical in the OPEN position
- Blades enter the center of their respective jaws at approximately the same time on CLOSING.
- In the CLOSED position, the blades must be in full contact and horizontal within tolerances.
- On opening, the blades should rotate to relieve the jaw contact pressure. If the blade remains flat, the blade beaver tail will engage the stops formed on the jaw fingers and further operating effort can be result in damage. Re-check the position of the base crank. The base crank should be rotated to the

maximum counter-clockwise position with the blade closed.

After the corona rings and balls are installed (if provided) the TTR8 Switch is ready for service.

9. TERMINAL CONNECTIONS

The aluminum surface of the terminal connection provides for easy current transfer.

*Notice: In cases where a copper conductor is used, bolt a tinned terminal clamp (if available) to the aluminum switch terminal pad.*

*If a non-tinned terminal clamp is used, apply a liberal amount of electrical joint grease at the joint and all over the pad of the fitting.*

9.1 Connecting Aluminum-to-Aluminum Terminals

To connect aluminum-to-aluminum terminals:

- 1. Clean all contact surfaces of conductors and fittings using a stiff wire brush to remove heavy oxide coatings until the aluminum finish is visible and restored.
- 2. Coat these now clean contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID "A Special" or No. 2 EJC.
- 3. Abrade the contact surface through the corrosion inhibitor again using the stiff wire brush.

*Notice: Do not remove the compound.*

- 4. Connect the terminals and torque the bolts as per Table 3.

Table 3 Recommended Torque for Aluminum Bolts				
Bolt Diam.	Lubricated Threads		Dry Threads	
1/2-inch	240 in.-lbs	20 ft-lbs	420 in.-lbs	35 ft-lbs
5/8-inch	480 in.-lbs	40 ft-lbs	720 in.-lbs	60 ft-lbs
3/4-inch	720 in.-lbs	60 ft-lbs	1140 in.-lbs	95 ft-lbs



9.2 Connecting Copper-to-Aluminum Terminals

To connect copper-to-aluminum terminals:

- 1. Except for plated surfaces, clean all contact surfaces of conductors and fittings using a stiff wire brush to remove heavy oxide coatings until the aluminum finish is visible and restored.

Notice: Do not abrade any plated surfaces.

- 2. Prepare any bare copper surfaces in the usual manner.
- 3. Coat these now clean contact areas with a liberal amount of corrosion inhibitor such as NO-OX-ID "A Special" or No. 2 EJC.
- 4. Abrade the contact surface through the corrosion inhibitor using a stiff wire brush.

Notice: Do not remove the electrical joint grease.

- 5. Connect the terminals and torque the bolts as per Table 3.

10. MAINTENANCE

Maintaining the TTR8 Switch includes inspection. The frequency of inspection depends upon atmospheric conditions and frequency of operation. The service interval is largely determined by the user.

Refer to ANSI C37.35 for recommended maintenance for high voltage air disconnect and interrupter switches.

WARNING

Before performing any maintenance, be sure that the TTR8 Switch is disconnected from all electrical power sources and properly grounded.

Complete the maintenance checklist items listed in the table to assure that all proper maintenance is carried out.

Notice: Contaminated environments or operation in sleet conditions also may require applying the lubricants at pivot points. The grease should be durable and able to retain its viscosity over a wide temperature range.

TTR8 Switch Maintenance Checklist	
Item to Check	Check
Under normal service conditions, inspect the jaw contacts at least once a year .	
Examine contacts to be sure that they are aligned, clean, and have a firm uniform pressure.	
If contacts are pitted or burned, remove and replace the old contacts with new ones.	
Clean the contact surfaces thoroughly by scraping off any contamination or deposit.	
After cleaning the contacts, apply a coat of lubricant, either DARINA #2 Grease or NO-OX-ID Grade "A" Special.	

11. RENEWAL PARTS

Refer to the switch nameplate (Fig. 17) when ordering renewal parts. The nameplate is attached to the base assembly of each switch pole. The same data is shown on the record engineering drawings. The master file at the factory is linked to the serial number on the nameplate.

The following information is required when ordering renewal parts from the factory:

- Switch Type
- Part Name
- Quantity Required
- Serial Number
- Maximum kV
- BIL kV
- Continuous Current (Amps)
- Momentary Current (Amps)

TYPE **TTR-8** SER. **24-60000** NOM.KV **115**

MAX.KV **121** BIL KV **550** CONT. AMPS **600**

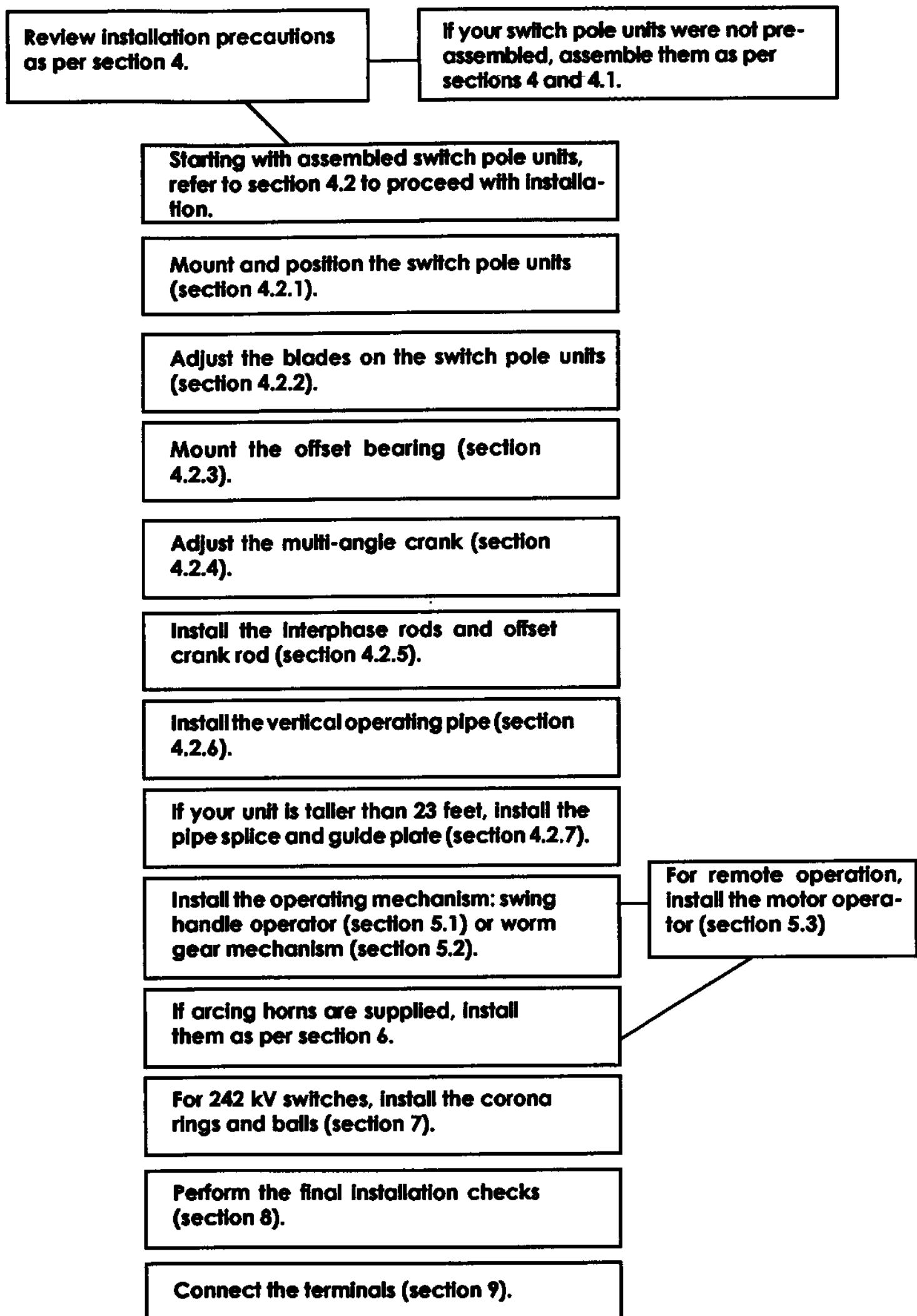
⊕ MOM. AMP **40000** A.C.C.C. **DO6** ⊕

ABB

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Figure 17  
Switch Nameplate

**Flow Chart for Installing the TTR8 Switch**



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